1. Introduction

This is the Catalogue Interoperability Protocol (CIP) Specification Release B. This document was developed under the auspices of the Committee on Earth Observation Satellites (CEOS) - Working Group on Information Systems and Services (WGISS) - Protocol Task Team (PTT). A complete list of organisations participating in the PTT is provided in the PTT Terms of Reference [PTT].

The PTT is developing a suite of documents as defined in the PTT Development Plan[PLAN]. The Interoperable Catalogue System (ICS) User Requirements Document (URD)[URD] is where the CEOS agencies bring in their needs for functionality, constraints, etc. The PTT accepts input as requirements added to the URD. It is the PTT's activity to interpret those requirements into the CIP Specification (this document), the ICS Guide Protocol (IGP) Specification[IGP] and the ICS System Design Document (SDD)[SDD]. The SDD may generate new requirements, derived from doing the system design, which are made explicit on occasion. The SDD is written for a federation of CEOS agency systems, however other data provider federations could use the SDD as a template design for their system. In order to be interoperable with other CIP systems, it is advised to use the CIP Valids document[VALID] that complements the CIP by providing controlled term lists.

The CIP is the result of an initiative to develop a protocol so that a number of international agencies can make their Earth Observation data, and related data, available in a coherent manner to their user communities. Already many of the agencies have catalogue systems that provide end users with access to Earth observation data. But there is currently little formal cohesion between the various systems. The CIP is designed to support the communication between user client software and the data provider server software and also between the information providers themselves.

The CIP is based upon the international search and retrieval protocol Z39.50-1995[Z3950]. The Z39.50 protocol is designed for information search and retrieval within a generic domain. The powerful services and data structures that Z39.50 supports makes it ideal for the basis of an Earth observation domain search and retrieval protocol.

1.1 Purpose and Scope

The purpose of this document is to define how the Z39.50 protocol can be used to satisfy the requirements as specified in the ICS URD[URD].

Whilst the primary intended readers of this document are CIP implementers, this document is also intended for CIP users so that they can understand the functionality that the CIP shall provide and see the potential of the CIP compliant client software. The reader is not assumed to be an in-depth expert on Z39.50 a priori. Therefore, the document covers the following areas:

- ***An overview of Catalogue Interoperability:*** This section describes important CIP, IGP and ICS concepts including the CIP domain model, collections, attributes , browse, order, security and authentication services. This section also includes descriptions of how a CIP Retrieval Manager will operate within the CIP domain. Although this is formally outside the scope of this specification, it provides important supplementary information to further understanding of the CIP domain.
- ***Specification of a Z39.50 'profile'***: A 'profile' specifies the use of a particular standard (in this case Z39.50) to support a particular application, function, community or environment, in this case the Earth observation domain. The profile sections of this document are the formal parts of the specification and should be considered as a delta or addition to the full Z39.50 specification. It defines the parts of the full Z39.50 specification that are applicable for the CIP, those optional parts of Z39.50 that are in this case mandatory and makes clear those Z39.50 services that are excluded. It also defines the CIP specific information that shall be handled by Z39.50. This includes the following:

- ***Specification of a set of attributes for the Earth observation domain***: Z39.50 itself does not apply to any specific domain, but the *attribute set* that is specified in a profile customises the protocol for a particular domain (for example, the *attribute set* bib-1 in Appendix ATR of Z39.50 is for the bibliographic domain). An *attribute set* specifies:
  - the fields that may be searched within the target database;
  - the relationship operations that may be used in the query language, such as 'less than', 'equal to', 'overlapping', etc.;
  - any qualifiers that must be supplied for the search query.
- ***Specification of a set of elements and retrieval formats for the Earth observation domain***: Z39.50 must be tailored in the results that it provides for the particular domain of interest. This is done through the definition of a set of *elements* and of the presentation format of the retrieved records. The *elements* are the data entities that are delivered, as opposed to *attributes* which are used for searching (of course, there may be significant overlap between the two sets). A retrieval format is the *schema* for delivery of the *elements*. Note that there may be more than one retrieval format for the *elements* retrieved (i.e. the *elements* can be presented in more than one way).

This document defines the consolidation of the second release of the CIP, the CIP Release B. The CIP Release A Specification[CIP-A] was completed and ratified by the PTT in March 1996. In March 1997, CIP Release B [CIP-B] was ratified. Preliminary requirements targeting the next CIP release, Release C have been already stated in the ICS URD. Each of the requirements is labelled as either release A, B or C.

Note that detailed client and Retrieval Manager requirements and a formal client and Retrieval Manager architectural design are outside the scope of this specification.

Details with respect to future CIP development and CIP related document can be found in the CEOS Protocol Task Team Development Plan[PLAN].

The lead agency for compilation of PTT inputs and for final preparation of this version of the document was the CEO. A complete list of organisations participating in the PTT is provided in the PTT Terms of Reference [PTT].

1.2 A Guide To PTT Documents

The CEOS Protocol Task Team (PTT) collects requirements for an interoperable infrastructure connecting Earth-observation data catalogues and access systems. It establishes agreement on these requirements and produces detailed specifications on which system implementations can be based. The PTT has named this interoperable infrastructure the CEOS Interoperable Catalogue System (ICS). The PTT output is captured and maintained in the documents listed below. A discussion of which document a user might read first is provided after the list of PTT documents.

- **ICS User Requirements Document (URD)**

  The ICS URD [URD]. specifies user requirements for an interoperable infrastructure linking catalogue systems of different agencies. For this purpose it defines requirements for all interoperable components and the protocols needed for exchanging messages between them. (Currently, the URD does not reflect the http approach to guide and will be updated.)

- **ICS System Design Document (SDD)**

  The ICS SDD [SDD]. defines the elements and interfaces which comprise the CEOS Interoperable Catalogue System (ICS). The SDD provides diagrams showing the interrelations between ICS elements, scenarios to explain the dynamic interaction, a data model showing the data relations, the communications services utilised in ICS, and the system management approach for ICS. The SDD provides both design and tutorial information.

- **Catalogue Interoperability Protocol (CIP) Specification - Release B**

  The CIP Specification (this document) defines the interoperable protocol for exchanging messages related to data search and data ordering. CIP is defined as a profile of the ISO standard Z39.50 with extensions for distributed searching using the collections model. The specification defines all CIP messages, as well as the attributes used for searching and the elements needed for retrieval. CIP may be used outside of the CEOS ICS. The CIP Specification is the definitive source for determining CIP compliance. The CIP Specification provides the framework for exchanging data orders. Details on how to specify options on orders are defined in the Order Options Amendment to the CIP Specification [ORD].

- **ICS Guide Design and Protocol Specification**

  The ICS Guide Design and Protocol Specification [IGP] describes the ICS elements that support guide and the protocol of messages used for guide. The approach is based on the http protocol using virtual documents. The interaction of the Guide elements with CIP elements is discussed. Example scenarios describe the dynamic behaviour. The ICS Guide Design and Protocol Specification is the definitive source for determining ICS Guide Protocol (IGP) compliance.

- **ICS Collection Manual**

  The ICS Collection Manual [CM]. provides procedures and guidelines for the creation and maintenance of Collection Information contained in an ICS Retrieval Manager. The document provides sufficient detail to allow the Retrieval Manager Administrators to manage the ICS Collection repositories according to the rules specified in the Collection Manual. The manual further provides guidelines for developing the ICS Collection Structure. Collectively, the procedures and guidelines; which can be applied to any/all implementation strategies, if followed, will ensure data interoperability.

- **ICS Valids Document**

  The ICS Valids Document [VALID] defines the list of valid keywords for the enumerated search attributes used by CIP. The valids document provides the procedures for controlling the list of valids either based on co-ordination with other standardisation groups or through rules and procedures for ICS only valids

A starting point for most users of PTT documents will be the SDD which provides tutorial information about how CIP, IGP and Collections are used in ICS. An implementor who wants the details of CIP messages may want to go directly to the CIP Specification. This is also true for an IGP implementer who may want to go directly to the Guide Design and Protocol Specification. Someone who is responsible for organising the data for an agency may want to browse the SDD to understand the ICS data model and then proceed to the details in the Collections Manual and the Valids Document. If technical input to the PTT direction is desired, reviewing the URD and proposing new User Requirements is the right approach.

Additional information about PTT activities and documents can be found at [PTT].

1.3 Glossary

1.3.1 Acronyms

ANSI	American National Standards Institute
APDU	Application Protocol Data Unit
ARS	Abstract Record Structure
ASCII	American Standard Code for Information Interchange
ASN.1	Abstract Syntax Notation One
BSSC	Board for Software Standardisation and Control
CCSDS	Consultative Committee for Space Data Systems
CEOS	Committee on Earth Observation Satellites
CGI	Common Gateway Interface
CID	Collection Identifier
CINTEX	CEOS Interoperability Experiment
CIP	Catalogue Interoperability Protocol
CM	Collection Member
DBMS	Database Management System
DEDSL	Data Entity Dictionary Specification Language
DLR	Deutsche Forschungsanstalt für Luft und Raumfahrt
DPRS	Data Packaging and Retrieval Study
DTD	Document Type Declaration
ECS	EOSDIS Core System
EO	Earth Observation
EORP	Earth Observation Retrieval Protocol
EOS	Earth Observing System
EOSDIS	Earth Observing System Data Information System
ERS	European Remote Sensing Satellite
ES	Extended Services
ESA	European Space Agency
ESRIN	European Space Research Institute
FGDC	Federal Geographic Data Committee
FTP	File Transfer Protocol
GCMD	Global Change Master Directory
GEO	Z39.50 Application Profile for Geospatial Metadata
GMT	Greenwich Mean Time
GRS	Generic Record Syntax
GSFC	Goddard Space Flight Centre
GUI	Graphical User Interface
HDF	Hierarchical Data Format
HTML	Hyper-Text Mark-up Language
HTTP	Hyper-Text Transfer Protocol
ICS	Interoperable Catalogue System
IGP	ICS Guide Protocol
ID	Identifier
IEEE	Institute of Electrical and Electronic Engineering
IMS	Information Management System

IPC	Inter-Process Communication
ISO	International Standards Organisation
LOHS	Local Order Handling System
MAC	Message Authentication Code
MB	Mega Bytes
N/A	Not Applicable
NASA	National Aeronautics And Space Administration
NISO	National Information Standards Organisation
OHS	Order Handling System
OID	Object Identifier
OMT	Object Modelling Technique
PDU	Protocol Data Unit
PGP	Pretty Good Privacy
PTT	Protocol Task Team
PVL	Parameter Value Language
QA	Quality Assurance
RID	Review Item Discrepancy
RM	Retrieval Manager
RPN	Reverse Polish Notation
RSN	Result Set Name
SAR	Synthetic Aperture Radar
SDD	System Design Document
SGML	Standard Generalized Mark-up Language
SQL	Standard Query Language
SUTRS	Simple Unstructured Text Record Syntax
TBD	To Be Defined
TCP/IP	Transmission Control Protocol/Internet Protocol
URD	User Requirements Document
URL	Universal Resource Locator
WGISS	Working Group on Information Systems and Services
WWW	World Wide Web
ZIG	Z39.50 Implementers Group

1.3.2 Definitions

1.3.2.1 CIP Domain Definitions

This section provides definitions of the terms related to the CIP domain.

Archive	An archive of EO data can hold various types of data ranging from satellite images and climatological products processed from the images, to observation data and climatological statistics. An archive may also contain information describing the EO data and also supplementary data such as design documentation, algorithm, object and source code, technical reports, user manuals, etc. There is likely to be a database management system for maintenance and low level access to the data. The archive will, in general, be accessed by a front end archive server that then presents the data as requested by the Retrieval Manager.

Attribute	An attribute is one of the features of an EO collection or product that is of interest to the user that can be presented or searched on using the CIP. For example, SATELLITE IDENTIFIER, INSTRUMENT, LATITUDE, etc. A set of special attributes, such as MEANING, UNITS, ALIAS, etc., is used to define the meaning of the attributes in a common and unambiguous manner. These attributes are called semantic attributes, The semantic attributes are interchanged by the CIP in the process of passing definitions of attributes between a CIP client and the Retrieval Manager. For further details on attributes, and their definition with semantic attributes, see Appendix A.
Browse data	Browse data is a derived representation or summary of data attributes that is provided by a catalogue system to facilitate user selection of EO products. The form and content of browse data is dependent on the nature of the EO data and the data selection criteria necessary for a science discipline to evaluate the EO data. A given EO product may be represented by several different browse data. For example with multi-channel data, browse data from one of several different channels or combinations of different channels may be required in order to represent different geophysical parameters and/or selection criteria. In addition a single large EO product may be represented by multiple browse data which depict specific regions or subsections of the EO product. Browse data is produced from the application of a browse service on an EO product, either dynamically at the time the browse data is requested by a user or as output which is stored as a system resource for retrieval at a later time. Examples of browse data include; 1 bit attribute maps (i.e., cloud mask), JPEG compressed images, sub-sampled reduced resolution images, data statistics and histograms).
Catalogue site	A catalogue site is a single physical location where catalogue systems are implemented. A catalogue site is typically an agency facility. Currently there are many catalogue systems within many catalogue sites, it is the aim of the CIP to bring these together so as to present them to the user as a single Interoperable Catalogues System.
Catalogue system	A catalogue system provides services such as inventory, browse, directory, order and guide, which may be supplemented by further services, but must contain at a minimum, inventory. The CIP is the protocol that shall enable the many services of many catalogue systems to interoperate. Usually a catalogue system resides at a particular agency or data provider facility.
Client	Within the context of the CIP the 'client' is the software used by the user at their own site to communicate with the catalogue system. This client software will communicate using the CIP with the Retrieval Manager. A CIP client must enable the user to take full advantage of the CIP supported functions, but this is not mandatory, i.e. non CIP clients (e.g. WWW clients) will also support interaction between the user and the catalogue system.
Collection	A grouping of item descriptors that have commonality. A collection consists of a number of attributes that describe the collective contents of the collection, the values of these attributes can then be searched on to select items of interest to the user. Collections also have members; these are the unique identifiers of the items that are grouped by the collection rather than their collective descriptions. As collection members can be identifiers of other collections, a hierarchy[1] of collections and product members can be established, therefore permitting a flexible and powerful organisation of data See also Section 2.
Guide data	Data that is available to the user to enhance understanding of the EO data, spacecraft, instrument, etc. and hence make a detailed analysis of whether the product data will be of value for a particular application. Guide data may also contain information necessary for processing the product data further, such as calibration coefficients.
Interoperability	The ability to provide a data user with the appearance of a single, unified catalogue. In order to provide catalogue interoperability all participating data providers must support at least one common method (i.e., API) for accessing user functions such as authentication, directory, inventory, guide and order. Each data provider may support additional user functional interfaces to support their private data users.
Interoperable catalogue system	A network of catalogue systems which provide users a view on each other. Each catalogue system is free to decide which collections of other catalogue systems are visible to its users, although some guidelines will have to be followed to ensure compatibility between collections and support commonality. Each individual catalogue system acts as an access point to the Interoperable Catalogue System and is generally served by a Retrieval Manager.

[1] Note that the collection hierarchy is actually a 'directed graph'.

Inventory	An inventory holds information about the data held in an archive. An inventory and archive should not be assumed to be the same thing, although they may in some cases be synonymous. An inventory is effectively a register of the EO data that is available for retrieval; it holds inventory entries which describe the EO products themselves. These inventory entries should not be assumed to have a one-to-one relationship with the individual data items held in an archive as a product may be formed by combinations of archive data items after further processing and in different formats. Likewise there may not be a one-to-one relationship between the inventory entry and the delivered EO product, as the user may specify a number of parameters within the order process that can result in a number of products from a single identified inventory entry. Further, the relationship between inventory entries and archive data items may be, in some cases, less concrete as inventory entries may also exist for data that is not as yet in the archive, for instance, the data has not yet been acquired by the archive system. For example, the ESA ERS-1/2 system does not distinguish between archived data and data yet to be acquired. In the ERS-1/2 system, the products ordered by a user is labelled an 'Observation Set' such that the observation could have occurred or is yet to occur. Whilst inventories do and will exist they are not modelled explicitly within the CIP domain. This is because the CIP domain sees each inventory entry as a separate product descriptor and never accesses data as a single complete inventory. Collections can be established that directly map to existing inventories, but the collection concept is not restricted to such groupings only. Therefore, inventories will still exist physically but not at the logical level in the CIP model.
Inventory entry	The term inventory entry is not used explicitly within the CIP domain model and it is only used within historical perspectives in the document as it has been superseded by the 'collection' and 'product descriptor' terminology. Previously within CEOS work it was used to represent a description of an inventory item (in general mapping on to an EO product) enabling product identification and retrieval. In the CIP model it is mapped to a product descriptor, primarily as the use of inventory entry logically makes little sense without the use of the term inventory.
Item	In the context of the CIP domain, an item is a piece of data that the user is interested in. An item may be an EO product as described in a collection or a collection. The term 'item' is used to generalise these different data objects so that general models for describing and searching for particular data objects can be developed. Each item in the catalogue system that the user may be interested in is described in some manner using an 'item descriptor'.
Item descriptor	An item descriptor is comprised of one or more attributes. The attributes describe the item in question in a consistent manner, therefore resulting in dynamically defined item instances. The item descriptor is used to represent a number of key objects in the CIP domain, such as a product descriptor. The attributes and their values, that constitute the item descriptor, can be searched on so as to identify a particular item descriptor or group of item descriptors .
On-line order	An on-line order is an order which the user places interactively with the client software that is being used. The on-line order object must contain the identifier(s) of the items to be ordered, plus enough information about the user to verify authentication, price, etc. An on-line order does not necessarily imply that the communication between the user and the Retrieval Manager must be synchronous (i.e. that at the communication level, e.g. TCP/IP, a session is permanently maintained), as this is immaterial. The fundamental fact is that the user initiates the order only once and at one single time (as opposed to a Standing Order, which is likely to be repeated and independent of the User once established).
Operation	An initiating request and the corresponding terminating response, along with intervening related messages. For example, a Search operation always includes a Search request and Search response, and may also include access control and resource control messages."
Order	An order is the physical item resulting from an order request. It can comprise one or more packages or products contained in delivery items. An order is the result of an order process occurring within the ICS domain, which may have involved multiple Retrieval Managers and be preceded by the use of other CIP services to establish the location and existence of the data required for the order.

Order request	An order request is placed by the user when the unique identifiers of EO products that are desired by the user have been obtained, possibly from the result of a search query. Also the user must have obtained/specified all necessary information relating to an order options, such as product type, price, format, media, delivery etc. An order request contains a unique identifier so that orders can be traced and progress can be reported.
Options	Options define the framework in which the access by a user to the CIP domain is performed. Two kinds of options can be distinguished. The first, session options provide the framework for sessions between a user and a Retrieval Manager, for example through a user profile. The second type, service options provide the framework for the access of item descriptors by users. Service options are particularly important in the order process. Service options are related to the following: • the user placing the order (e.g. via the group membership used by the user for the definition of an order request) what is available to that user, the special discounts for a user, the pricing structure for a user, etc. • the item descriptors accessed for ordering purposes, i.e. an item's price, any special offers, the formats that the item is available in, the media that it can be delivered on, etc. • the data provider that provide the products to be ordered and defines the options for their access. In this respect, a set of service options are analogous to an order information database in which the service options contain data that relates order information to users and also data that relates order information to particular item descriptors .
Product	See the definition of 'product data'.
Product data	A unique aggregation of data generated from information held in, or to be held in an archive (for predicted products). It can be located and retrieved by a user via the CIP, possibly following further processing, such as map projection, sub-setting, band selection, etc., after or during extraction of the raw data as stored in the archive. Whilst the data may be stored in an archive in a quite different format to that delivered to the user, the user is not normally aware of this. Further, the data may not be present in the archive at the time of order or may be generated on the fly as a result of the order. The user only sees, from item descriptors, product data that may be delivered. Of course there may be further information that is required which will change the format of delivery, but to the user it is still the same product data. The CIP does not prevent that the same archive item being held at different facilities (or providers), but it is assumed that each distinct item will be described by a different product descriptor.
Query	There are two types of query: • **Search query**: a search query can be used to search a number of item descriptors as identified by the target of the query. The query acts as a filter on the item descriptors, therefore producing a more limited list of item descriptors. The matches that are made are returned to the user. A search query is not restricted to a single search query language but the unique names of the item descriptors must be supported by the search query language. • **Status query**: a status query is directed towards a Retrieval Manager to check the status of a previous request, such as an on-going order or an on-going search query. There are other services that can act upon queries, such as cancel query, suspend query, etc., these control the flow of information between user and Retrieval Manager.
Quicklook	The term 'Quicklook' is used within some systems to refer to specific types of browse data, however the term is not consistently defined from one system to another. Within this document Quicklook is considered a closed subset of browse data and is not considered independently in terms of requirement specifications.
Result set	A result set is the list of items that are found as the result of a search on a database, be that a collection database or a product descriptor database.

Retrieval Manager	A Retrieval Manager services (and may be installed at) each catalogue site, it is used to integrate together the local catalogue systems and provide communication between users and other catalogue site Retrieval Managers. It is anticipated that each catalogue site would have at least one Retrieval Manager and that Retrieval Manager would 'know about' or 'own' a number of collections. The data within these collections would be the responsibility of that Retrieval Manager, with external collections referenced only and managed by their respective Retrieval Managers. The Retrieval Managers at each catalogue site would also communicate with each other using the CIP. The Retrieval Manager would then also communicate with local catalogue servers, such as archives and inventories, within its own site to services requests received from users. Another key function of the Retrieval Manager is to route search queries to other relevant Retrieval Managers and consolidate the search results before returning them to the user .
Semantic Attribute	See 'Attribute'.
Server	Within the context of the CIP the 'server' could be seen as the Retrieval Manager, as this services the requests and results for the user. Also, however within the CIP domain there is the concept of local catalogue servers; these are the servers that must be attached to the front of existing catalogue systems, such as archives and inventories, so that they can in turn serve the Retrieval Manager.
Standing order	A standing order is an order that is not placed by a user, but by a simulated user such as a scheduler. These types of order are for situations when a user knows exactly the EO product that is wanted and knows that a new version of that product is produced on a regular basis. The standing order means that the user does not make repeated separate orders for each new product. Whilst a user will establish a standing-order and status queries can be made on the standing order, the same as any other order, there is no further user interaction apart from to cancel or stop the standing order. The same functionality as applied to on-line orders are applied to standing orders, such as user authentication, account checking, etc. Note that standing orders are not defined in CIP-B.
Sub-selection	The sub-selection product is an EO product where a number of parameters have been included in the order information so that only a sub-selection of the full product is requested and delivered. For example, from a product covering the whole of Europe, only the geographical area of France is sub-selected and returned to the user.
User	The user represents the combination of a real human user and the client software that the human user is using to interface with the Retrieval Manager. The CIP is not concerned directly with the client software, although the CIP has to be able to support the tasks that the user wishes to achieve, and it is anticipated that in general, the actual CIP should be transparent to the user. This is analogous to a human not directly interacting with TCP/IP, but being aware that it satisfies the task of data transfer. The only exceptions to this may be when the user is controlling a query or when error or state information is generated by the CIP under anomalous circumstances. The user has a number of important properties, such as a unique identifier, option, etc. (of course this does not exclude an anonymous user having a set of default properties). Generally, the user can perform three types of tasks, either place a query or place an order or control a session. Note that there is also a special type of user in the CIP domain and that is a non-human user such as another Retrieval Manager or a scheduler. These could for example place orders as required, without human interaction, apart from the initial set-up of the schedule.
User session	A user session represents the interaction between a human user and the CIP (i.e. a Retrieval Manager), which has in general been established by the user via a terminal which may be running a WWW client or a specific CIP client MMI. This, within CIP-B, will be an authenticated session, e.g. with the transmission and acceptance of a user name and password The term 'log on' is used within this document to mean the establishing of a user interaction session with a catalogue system supported within the CIP domain. In this context, the word 'session' should not be interpreted in terms of communications sessions or states. A user interaction session is independent of the underlying communications layer. Note further, that as physical communications layers can be broken, it is likely that a user identifier will need to be retained within the CIP domain and therefore, user identifiers will be exchanged.
Valids	Valids are terms that belong to a list of controlled keywords. They play a key role in achieving interoperability, since all catalogues are described and can then be searched by the same terms (standard spelling and meaning). In ICS for example, valids are used to describe sensors. This implies that across all catalogues whenever a particular sensor is mentioned the exact same naming convention must be used.

1.3.2.2 Z39.50 Related Definitions

The following section provides the definition of the Z39.50 terminology used within the document. These definitions were taken directly from the Z39.50 Standard[Z3950].

Note that throughout this document, except when made clear from the context (i.e. when a Z39.50 ASN.1 definition is explained), Z39.50 terminology is highlighted in a *distinct font* (i.e. italics) to distinguish them from CIP terminology.

A-association	An *A-association* (Application association) is a communication session between a database user and a database provider. It may consist of one or more consecutive *Z-associations*.
Abstract database record	An *abstract database record* is an abstract representation of the information in a *database record*. An *abstract database record* may be formed by applying an *abstract record structure* (defined by a *schema*) to the *database record*. An *element specification* may be applied to an *abstract database record* forming another instance of the *abstract database record*.
Abstract record structure	An *abstract record structure* is the primary component of a *database schema*. An *abstract record structure* applied to a *database record* results in an *abstract database record*.
Access point	An *access point* is a unique or non-unique key that can be specified either singly or in combination with other *access points* in a search for records.
Attribute	An *attribute* is a characteristic of a *search term*, or one of several characteristic components which together form a characteristic of a *search term*.
Attribute set	An *attribute set* defines a set of *attribute types*, and for each *attribute type* a set of *attributes*. An *attribute set* is assigned an *attribute set id*.
Attribute set id	An *attribute set id* is an *Object Identifier (OID)* that identifies an *attribute set*.
Attribute type	An *attribute type* allows to conveniently group similar *attributes*. An *attribute type* is assigned a *value* and contains a set of *attributes*.
Client	The *client* is the application that includes the *origin*; i.e. the target database user.
Database	A *database* is a collection of information units containing related information. Each unit is a *database record*.
Database record	A *database record* is a local data structure representing an information unit in a *database*.
Database schema	A *database schema* is a common understanding shared by the *origin* and *target* of the information contained in the records of the *database*, which allows the subsequent selection of portions of that information via an *element specification*. A *schema* defines an *abstract record structure*, which when applied to a *database record*, results in an *abstract database record*.
Element	An *element* is the smallest unit of information used to define the *schema elements* which in turn define a *schema*.
Element set name	An *element set name* is an *element specification* in the form of a *primitive name*.
Element specification	An *element specification* is an instance of an *element specification format*, or an *element set name*. An *element specification* transforms an *abstract database record* into another instance of the *abstract database record* (this may be a null transformation). The *element specification* selects elements from the *abstract database record*, and possibly also specifies variant forms for those *elements*.
Element specification format	An *element specification format* is a structure used to express an *element specification*.
Element specification identifier	An *element specification identifier* is the object identifier of an *element specification format*, or an *element set name*.
Explain facility	The *explain facility* is comprised of the *Explain Database* and services to search and retrieve information from this database. The standard Z39.50 search and retrieval facilities are used to access the *explain database*
Explain Record	An entry in the *explain database*. Different categories of explain records exist. For example *target server* explain record.
Extended services facility	The *extended-services facility* consists of the single service, *extended-services.*
Extended service	The *extended-services* allow and origin to create, modify or delete a *task package* at a *target*.

Facility	A logical group of Z390.50 *services*. Each Z39.50 *facility* is composed of one or more *services*. For example, the *Initialisation Facility* is composed of the *InitializeRequest* service and the *InitializeResponse* service. Alternatively a facility might not consist of services but instead might use the services of another facility. For example, the *Explain* facility does not define any *services* but uses the *search* and *present* services.
Origin	The *origin* is the entity that initiates a *Z-association* and initiates operations during the *Z-association*.
Primitive name	A *primitive name* is a name whose internal structure is not required to be understood or have significance to users of the name.
Schema	A common understanding shared by the *client* and the *server* of the information contained in the records of the database. The *schema* is defined in terms of *schema elements*.
Schema element	A *schema element* is the unit of information contained in a *schema*. A *schema element* is defined in terms of *elements*.
Server	The *server* is the application that provides access to the *target*; the database provider.
Service	A *service* is a mechanism used by the *origin* or *target* to exchange information as part of a *facility* such as the *Search Facility*.
Tag	A *tag* is the identifier of an *element*. It consists of a *tag type* and a *tag value*.
Tag path	A *tag path* is the identifier of a *schema element*. A *tag path* consists of a sequence of *tags*, each identifying the constituting *elements* of a *schema element*.
Tag set	A *tag set* is the set of *tag values* (and recommended data types) for a set of *elements*.
Tag set id	A *tag set id* is an object identifier serving as a persistent identifier for a *tag set*.
Tag type	A *tag type* is a short-hand (integer) identifier for a *tag set*. A *schema* definition may assign a *tag type* to a *tag set id*, to identify a particular *tag set* within the context of the schema definition.
Tag value	A *tag value* is the identifier of an *element*. It may be either integer or string, and it is qualified by a *tag type*.
Target	The *target* is the entity that accepts a *Z-association* and is the target site for search requests and result retrieval
Task	A *task* is an activity which is started by an *origin* as the result of an *extended service request.*
Task package	A *task package* is the collection of attributes that describe a *task*.
Term	A *term* is an instance of an *attribute* that is used when searching for comparison with *database elements* (i.e. the value ‘47.2’ when searching database records which latitude is ‘greater than’ the value in the **term** provided).
Z-association	A *Z-association* is a session, explicitly established by the *origin* and either explicitly terminated by the *origin* or *target*, or implicitly terminated by termination of the *A-association*.

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